

CLAIMS

1. A device for treating mitral valve regurgitation, comprising:

a tubular member being sufficiently flexible to be transformable between a relatively straight delivery configuration and a deployed ring shape approximating the size and shape of a mitral valve annulus, the tubular member having a through lumen and a plurality of sidewall openings generally disposed around a perimeter of the deployed ring shape; and

a barb assembly comprising a filament extending through the lumen and a plurality of self-extendible barbs coupled to the filament and corresponding to the sidewall openings, the barb assembly being slidable within the lumen to align the barbs with the corresponding sidewall openings to permit self-extension of the barbs there through.

1. The device of claim 1 wherein the filament is a hollow tube.

3. The device of claim 2 wherein the barbs are formed integrally from the hollow tube.

4. The device of claim 2 wherein the hollow tube has a plurality of notches to increase axial flexibility of the barb assembly.

5. The device of claim 1 wherein the tubular member has a plurality of notches to increase axial flexibility thereof.

6. The device of claim 1 wherein the tubular member has a plurality of protruding anchors generally disposed around a perimeter of the deployed ring shape.

7. The device of claim 1 wherein the tubular member has a temporary barb disposed at a distal end thereof.

8. The device of claim 1 further comprising a lock mechanism disposed upon the filament for locking the device in the deployed ring shape.
9. The device of claim 8 wherein the lock mechanism comprises:
a lock disposed at a proximal end of the filament and having a lumen there through, and
at least one key member disposed at a distal end of the filament and having a key body and a deflectable tab disposed on the key body, the deflectable tab being normally angled away from the filament and being elastically deflectable towards the filament to allow the at least one key member to pass through lock lumen in only one direction.
10. The device of claim 8 wherein the lock mechanism comprises:
a tab disposed at a distal end of the tubular member and biased toward the lumen, the tab having an opening there through for receiving a pull cord;
a plurality of keyholes disposed at a distal end of the filament, each of the keyholes sized to be engaged by the tab;
an unlocking cord disposed through one of the plurality of keyholes;
a lock support tube for abutting the distal end of the tubular member and for holding the tubular member stationary; and
a push tube for abutting the distal end of the filament.
11. The device of claim 1 further comprising:
a cord ring disposed at a distal end of the filament; and
a reshaping cord having first and second ends and being threaded through the cord ring.
12. The device of claim 1 further comprising:

a stop attached to the tubular member and extending into the lumen, the stop being sized and shaped to prevent movement of the barb in one direction.

13. The device of claim 1 wherein the barbs comprise at least one material from the group consisting of nitinol, cobalt-based alloy, stainless steel, or combinations thereof.

14. A device for treating mitral valve regurgitation, comprising:
a reduction ring including a lumen and a plurality of openings formed in a side wall of the reduction ring;
a plurality of radially extendible barbs attached to the sidewall, wherein each of the plurality of radially extending barbs corresponds with one of the plurality of openings formed in the sidewall;
a filament received in the reduction ring lumen, the filament including a plurality of barb restraining devices for restraining the plurality of radially extending barbs when the device is in a delivery configuration,
wherein the reduction ring carrying the filament is deployed adjacent a mitral valve annulus and
wherein the filament is translated relative to the reduction ring to release the barbs from the restraining rings and deploy the barbs through the sidewall openings and into the annulus and further translation of the filament shapes the reduction ring with the deployed barbs to reshape the annulus.

15. The device of claim 10 wherein the radially extending barbs comprises at least one material from the group consisting of nitinol, cobalt based alloy, stainless steel, or combinations thereof.

16. A system for treating mitral valve regurgitation, the system comprising:
a device for treating mitral valve regurgitation in accordance with claim 1;

a delivery catheter; and
a locking mechanism disposed upon the filament for locking the device in a reduction configuration.

17. The system of claim 16 wherein the locking mechanism comprises a plurality of locking members securely attached to a distal portion of the filament and a lock attached to a proximal portion of the filament.

18. The system of claim 16 further comprising:
a wireform having a pre-shaped annular portion for placement adjacent a valve annulus, the wireform comprising a guide for delivering the delivery catheter to the valve annulus.

19. The system of claim 18 wherein the pre-shaped annular portion of the wireform comprises a shape memory material.

20. The system of claim 19 wherein the shape memory material comprises nitinol.

21. The system of claim 20 wherein the wireform further comprises a stabilizer portion extending distally from the pre-shaped annular portion.

22. The system of claim 21 wherein the stabilizer portion has a length sufficient to traverse a heart chamber and to contact a chamber wall opposite a heart valve.

23. The system of claim 21 wherein the wireform includes a soft distal tip.

24. The system of claim 21 wherein the stabilizer portion includes a plurality of radiopaque markers.

25. The system of claim 18 further comprising a wireform delivery catheter.

26. The system of claim 25 wherein the wireform delivery catheter comprises a restraining section for restraining the pre-shaped annular portion of the wireform when the wireform is disposed within the wireform delivery catheter.

27. The system of claim 26 wherein the restraining section of the wireform delivery catheter comprises a braided material embedded in a portion of a wall of the wireform delivery catheter.

28. The system of claim 18 wherein the wireform delivery catheter further comprises a guide section disposed along an outer surface of a distal portion of the delivery catheter, the guide section having a lumen there through for slidably receiving the wireform.

29. The system of claim 28 wherein the guide section comprises a plurality of aligned, spaced-apart segments each having a lumen there through for slidably receiving the wireform.

30. The system of claim 18 wherein the wireform comprises:
an outer tube having a lumen;
an inner core having a distal tip, the inner core disposed within the lumen of the outer tube and the distal tip attached to an inside surface of a distal end of the outer tube; and
a lock for locking the inner core relative to the outer tube when the outer tube is pulled into an annular configuration.

31. The system of claim 1 wherein the barbs are composed of a material chosen from a group consisting of nitinol, cobalt-based alloy, stainless steel, or combinations thereof.
32. A system for treating mitral valve regurgitation, the system comprising:
 means for reducing a mitral valve annulus;
 means for translating a filament relative to a reduction ring;
 means for inserting a plurality of barbs through reduction ring sidewall openings and into the mitral valve annulus responsive to the translation; and
 means for locking the filament relative to the reduction ring.
33. A method for treating mitral valve regurgitation, the method comprising:
 delivering to a mitral valve an annulus reduction assembly comprising a reduction ring and filament slidably disposed there through;
 deploying an annulus reduction assembly in a ring shape adjacent an annulus of the mitral valve;
 deploying a plurality of barbs disposed on the filament through reduction ring sidewall openings and into the annulus; and
 reforming the ring shape to reduce the valve annulus.
34. The method of claim 33 further comprising:
 locking the ring shape of the annulus reduction assembly.